



Pome fruit case study and orchard system

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FOOD
QUALITY
AND
SAFETY



Integrated Pest Management in Europe

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- 9 countries
 - BE, CH, DK, DE, ES, FR, IT, NL, SE
- 11 major European pome fruit production area



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- integrated control well established
 - corner stones
 - o spider mites – predatory mites
 - o pear psylla – predatory bugs
 - o wooly aphids – parasitoids and predators
 - o codling moth – mating disruption
 - o apple scab – warning system
- IPM practices known versus used
 - inventory on state of the art of IPM methods used
 - o questionnaire
 - o self expanding network
 - o analyses
- orchard system assessment
 - future development

> IFP in pome fruit

- long history - non-the-less: high pesticide use
- a lot of questions
 - what tools are available?
 - to what extent used in practice?
 - bottlenecks
 - o why not used?
 - o economic, practical, technical
- 3 pomefruit problems with high pesticide demand
 - codling moth (*Cydia pomonella*)
 - apple scab (*Venturia inaequalis*)
 - brown spot of pear (*Stemphylium vesicarium*)



> Innovative control of codling moth

- warning systems (DSS)
 - further development
- pheromone disruption
 - RAK, Isomate
- virus
 - granulosis virus
- other techniques



> Innovative control of apple scab

- resistant cultivars
- warning systems (DSS)
 - Rimpro
 - further development ongoing
- sanitation
 - survival on fallen leaves
 - leaf shredding
 - urea
 - removing leaves from orchards
- antagonists
 - *Microsphaeropsis*



> Brown spot of pear

- *Stemphylium vesicarium*
 - problem since 1980th and increasing
 - north Spain, north Italy, Rhone valley France, Belgium, Netherlands
- leaf drop and fruit rot



> Results questionnaire

- only “ready to use” IFP (IPM) methods
 - no method “still under development”
- get realistic data
 - sometimes easy, difficult
 - very variable: difficult to summarise
- judgement
 - lighter color: positive for integrated system
 - darker color: negative

> Summary codling moth 1

IFP tool	no. regions	use in practice	obstacles
pheromone traps	all	5 – 100	none
monitoring damage S	all	1 – 100	none
monitoring damage H	all	5 – 100	none
corrugated cardboards	none	1	labour
dss – adults	90	100	none
dss – oviposition	90	90	none
dss – larval emergence	all	100	none
dss – generations	90	90	none
dss – thresholds	50	70	none



> Summary codling moth 2

IFP tool	no. regions	use in practice	obstacles
non chemical			
sanitation	90	0 – 50	labour
mating disruption	100	25	labour, economic, practical
granulosis virus	90	10 – 100	practical
combinations	90	variable, low	labour, economic
chemical control			
priority IGR 's	50	20	none
alternation IGR 's	80	80	none

> Summary brown spot of pear

IFP tool	no. regions	use in practice	obstacles
population monitoring	75	75 – 90	economic
decision support	all	5 – 100	none
sanitation	all	0 – 5	labour
non chemical methods	none	0	technical
chemical			
protectant fungicides	all	100	none
alternation	all	90	none
resistant cultivars	none	0	economic, practical



> Summary apple scab

IFP tool	no. regions	use in practice	obstacles
cultural methods	50	0 – 10	economic, technical
monitoring	90	10 – 70	labour
decision support	all	50 – 100	none
sanitation	all	0 – 70	labour
chemical control			
protectant fungicides	all	100	none
alternation	all	90	none
resistant cultivars	none	0	none



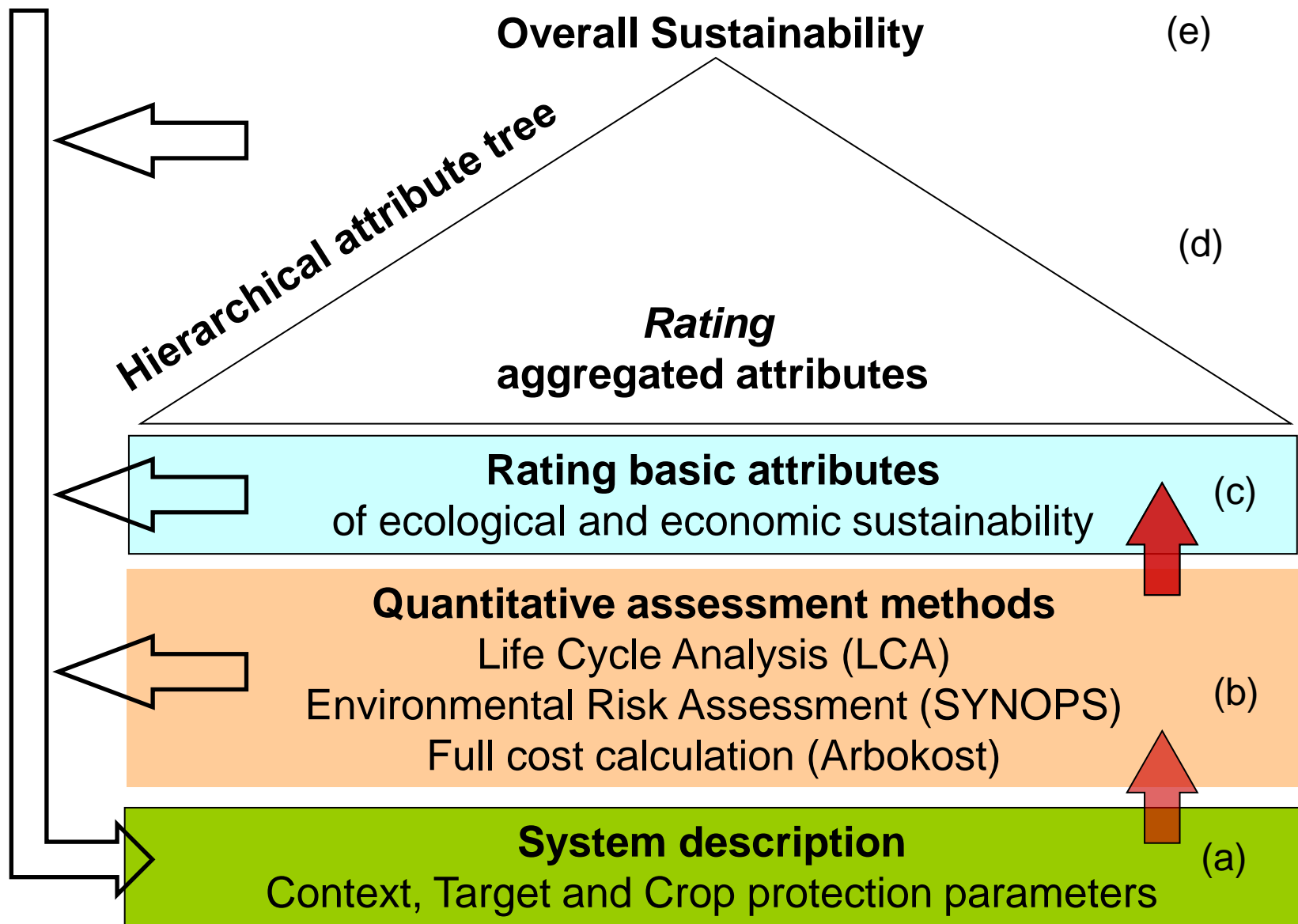
> Conclusions questionnaire

- knowledge IFP methods: quickly and well spread
 - spreading: governmental or private
 - extension services or advisors
 - decision support systems: widely used
 - information by modern communication (SMS, e-mail, website)
 - ready to use IPF tools: used everywhere in Europe
 - no differences between northern or southern regions
 - resistant cultivars: not used!
 - except organic growers
 - lack of selective pesticides
 - registration of products is tedious and costly
-
- hindrances to implement: e.g. economic & labour
 - development: assessment methodology orchard systems

> Background

- directive 2009/128/EC « sustainable use of pesticides »
 - integrated pest management
 - o careful consideration of all methods
 - o discourage harmful organisms
 - o keep intervention at economically and environmentally level
 - o minimise risk to human health & environment
- Orchard system case study
 - goal:
 - develop methodology to assess possible future orchard systems
 - o in line with 2009/128/EC
 - o quantitative

> 'SustainOS' methodology



> Orchard systems

- 4 apple orchard systems defined
 - base line system (BS)
 - advanced system 1 (AS1)
 - advanced system 2 (AS2)
 - innovative system (IS)
- Base line system (BS)
 - good practices
 - o resistance management
 - o beneficial organisms
 - pesticides allowed in 2009
 - o only synthetic
 - common (susceptible) apple cultivars
 - no drift reduction other than 3 m buffer zone

> Advanced systems

- Advanced system 1 (AS1)
 - good and best practices
 - apple scab resistant cultivars
 - mating disruption (codling moth), more hail nets, predatory mites, bio control (e.g. fire blight), cover crop
 - pesticides with low ecotoxicity (more antagonists)
 - drift reduction: 45 % of area
- Advanced system 2 (AS2)
 - similar to AS1 + . . .
 - mechanical weeding, enclosure netting, natural fungicides after bloom - no residues
 - drift reduction: 80 % of area

> Innovative system (IS)

- like AS2 + . . .
 - cultivars with multiple resistance
 - o apple scab
 - o powdery mildew
 - o fire blight
 - o aphids
 - new pesticides, with
 - o selective
 - o no effects on non target organisms

- contex parameters
 - overall quality parameters
 - orchard quality
 - infrastructure quality
 - drift reduction
 - decision support systems (dss)
 - labour
- target parameters
 - target yield
 - target price
 - impact on arthropods
 - impact on diseases
 - impact on beneficial organisms

> Comparison

- context parameters are region specific
 - no comparison possible between European regions
 - comparison between future orchard systems within a region
- basic quantitative information to describe and assess orchard systems
 - methods to control pests
 - o synthetic pesticides
 - o non chemical methods
 - date of application
 - dose
 - drift
 - etc.

> Example

Available alternative methods	Options		BS					AS1																					
			chosen options		target organisms			chosen options		target organisms																			
	1 mating disruption		-																										
	2 attract and kill		-																										
	3 sanitary methods		-																										
	4 masstrapping		-																										
	5 enclosure netting		-																										
	6 EPN (Nematodes)		-																										
	7 predators/parasitoids		-																										
	8 resistant varieties/rootstocks		-											x															
	9 push and pull plants/cultivars (attractance and repellance)		-																										
Insecticides / Acaricides	Options		compound per treatment			BS					AS1																		
	Insecticide group	Active ingredient	kg/l product per ha	% active ingredient	g a.i. per ha	Number of applications	calendar week	g AI per ha and season	target organisms					Number of applications	calendar week	g AI per ha and season	target organisms												
	1 pheromones	codlemone a.o.			0																								
	2 granulovirus				0																								
	3 IGR's (moulting inhibitors)	novaluron	0,96	10%	96	0,5	22	48	x	x																			
	4 IGR's (ecdysone mimics)	methoxyfenozid	0,64	24%	153,6	1	27	153,6	x	x																			
	5 IGR's (Jh mimics)	fenoxycarb	0,96	25%	240	0,5	20	120	x	x																			
	6 various	Indoxacarb	0,27	30%	81	1	31	81	x	x																			
	7 neonicotinoids	flonicamid	0,16	50%	80	1	25	80																					
	8 neonicotinoids	thiacloprid	0,32	40%	128	1	20	128																					
	9 organophosphates	chlorpyrifos-ethyl	2,4	23%	552	0,5	17	276																					
	10 acaricides	tebufenpyrad	0,32	20%	64	1	20	64																					
	11 oil		32	95%	30400	0,25	12	7600																					
	12 novel insecticide without non-target effects		?	?	?																								
	<i>Necessary number of sprays (drive trough orchard)</i>						2																						



> Conclusion

- parameters chosen
 - adequate to describe apple orchard systems
 - useful for quantitative data collection
 - collected data
 - o can be changed for different situations/conditions, European regions
 - o are valid now, but should be renewed, if an assessment is made e.g. 10 years from now
- results
 - apple orchards
 - can be adapted for other crops (PURE)
 - direct policy makers and decision makers

 - detailed results in next presentations